



ILLINOIS SUSTAINABLE
TECHNOLOGY CENTER
PRAIRIE RESEARCH INSTITUTE

Overview of Indoor Climate Research and Training

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October 16, 2012



UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

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Outline

- **ISTC Mission**
- **ISTC Programs**
- **Indoor Climate Research and Training (ICRT)**
- **Q/A**

ISTC Reporting and Organization

- **University of Illinois OVCR**
- **Prairie Research Institute (“Home of the Surveys”): Water, Geological, Natural History, Archeological, and ISTC**
- **Illinois Sustainable Technology Center**
 - **Indoor Climate Research and Training (ICRT)**
 - **Emerging Technologies and Assistance (ETAP)**
 - **Applied Research on Industrial and Environmental Systems (ARIES)**
 - **Sponsored Research, Public Engagement, and Communications (SRPEC)**

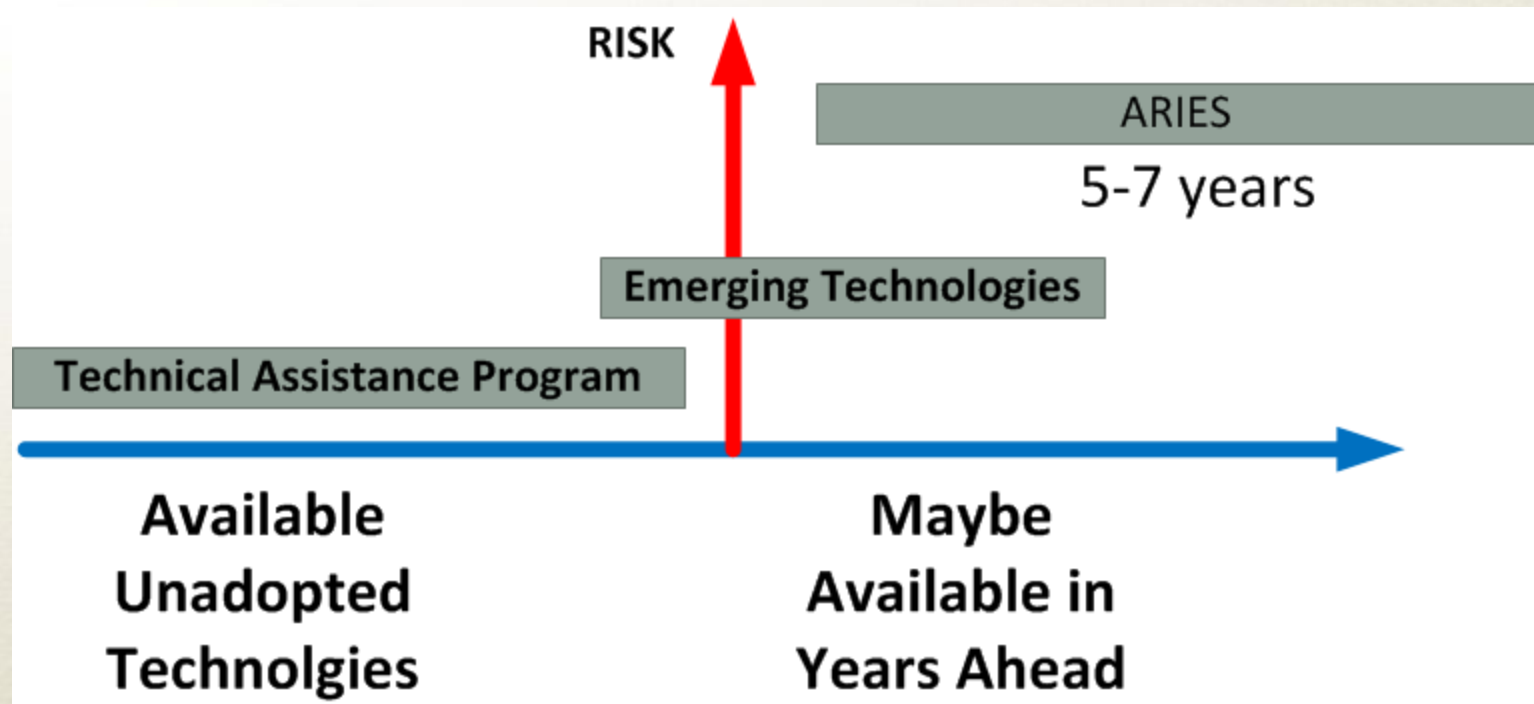
ISTC

- **Our State mandate is for,**
 - **Waste Reduction**
 - **Waste Management**
- **We consider ourselves as an Advocate for Energy and Environment**
- **We advance Sustainability through emerging technologies, technical assistance, and public engagement**

ISTC

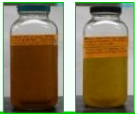
- **We have offices in Champaign, Chicago, Peoria, and Godfrey. That way we can outreach to industries and businesses all through Illinois.**
- **We have advanced laboratories and that is a unique strength we have when it comes to other technical assistance programs in the region or even nation. We focus on being a leader or partner in the sustainable research enterprise.**
- **Opportunities to leverage our efforts through other surveys, the campus, and beyond**

Applied vs. Emerging Technologies



Materials Use & Reuse

- Bio-oils/lubricants
- Biochar
- Plastics to Oil
- Supercapacitors
- Mud to Parks



Technical Assistance

- Waste Reduction
- Energy Reduction
- Water Conservation
- Indoor Climate Research & Training
- Manufacturing Process Improvement



Pollution Prevention

- Sustainable Electronics Initiative
- Environmental Fate and Transport
 - Pharmaceuticals and Personal Care Products (PPCPs)
 - Inorganics – Nutrients, Metals
 - Organics including Pesticides and Herbicides



Public Engagement

- Naturally Illinois Expo
- Governor's Sustainability Awards
- Sustainable Seminar Series
- Great Lakes Regional Pollution Prevention Roundtable
- Illinois Biochar Group
- Printers' National Environmental Assistance Center



ILLINOIS SUSTAINABLE TECHNOLOGY CENTER

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Water Use & Reuse

- Membrane Technologies
- Desalinization
- Water Conservation
 - Wastewater Treatment Plants
 - Cooling Towers
 - Ethanol Plants



Technology Demonstrations

- Biodiesel
- Hydro Turbines
- Osmotic Desalinization



ISTC

Promoting sustainable practices within Illinois and beyond through

- **on-site technical assistance**
- **applied research (in-house/extra-mural)**
- **training and**
- **client engagement**

Indoor Climate Research and Training

- **In large part, the following slides are from Paul Francisco, Coordinator of ICRT**

ICRT History

- **Operate one of the DOE-funded Weatherization Training Centers**
 - **Contacted by Governor's office Dec. 2009**
 - **Governor's office provided 20% cost-share**
 - **Awarded Aug. 2010**
 - **Lease signed Oct. 2011**
 - **First class Nov. 2011**

ICRT Facility

- **Grand Opening celebration held TODAY!**
- **Outfitting of Training Center has continued since lease signing**
 - **Classroom construction**
 - **A/V**
 - **HVAC lab**
 - **Pressure diagnostic props**
 - **Ventilation**
 - **Air sealing**

Who We Are

- **Indoor Climate Research & Training**
- **Research**
 - Mainly residential
 - Energy efficiency
 - Health & safety
 - Building durability
- **Training**
 - Energy auditors
 - Contractors

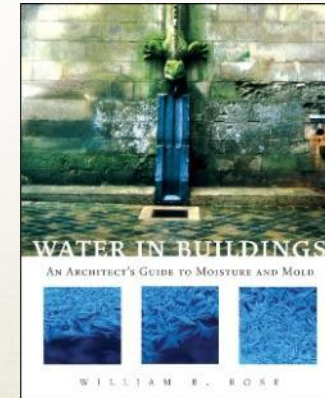


Who We Are

Paul Francisco



Who We Are



Bill Rose

Who We Are



Jeffrey Gordon


Who We Are



Zach Merrin



Indoor Climate

- **Energy use**
 - **Indoor air quality**
 - **Comfort**
- Indoor Environmental Quality**
- 

Research: HEALTH-V

- When energy retrofits are done...
- ...and different ventilation sizing strategies are used...
- ...what is the impact on IAQ?
- ...what is the impact on health outcomes?



Research: Building America

- **Gas Technology Institute is team lead**
 - We are a team member
- **Annual task orders based on task proposals**



Research: National Weatherization Evaluation Project

- **Many field studies**
 - Bulk fuel energy savings
 - IAQ impacts
 - Process evaluation



- **Both research and training of field staff**

Research: Residential Lead Hazards



- Evaluation Illinois' of Get the Lead Out program
- EPA Research project to measure rehab worker's lead exposures
- Co-author of National Park Service "Lead Paint and Historic Buildings"
- **Current:** pilot project to reduce exposures thru window replacement

Research: Unvented Gas Fireplaces



Figure 2: CO Concentration

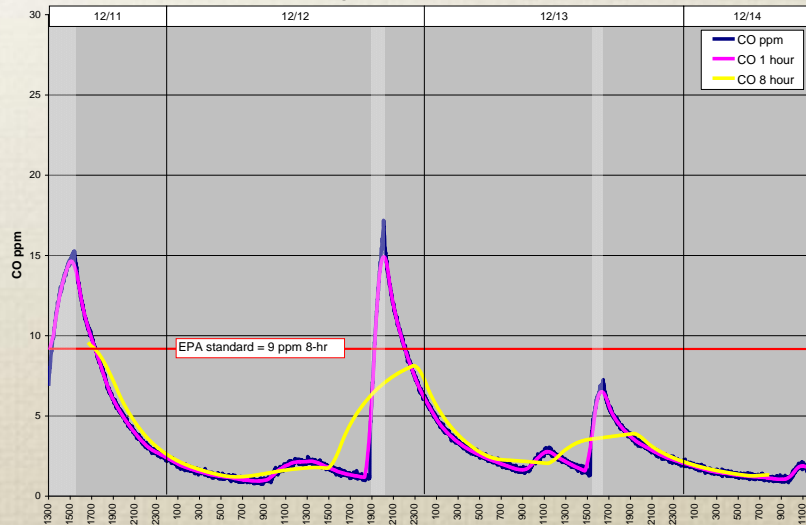
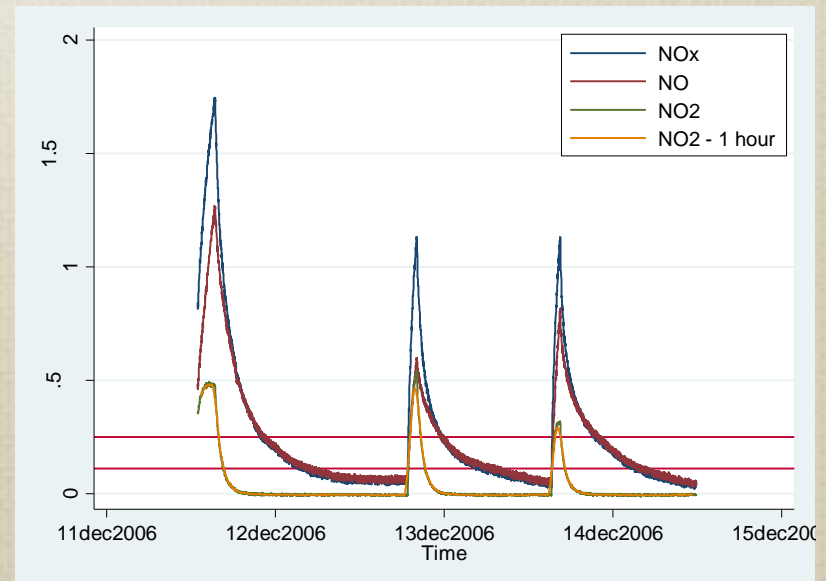
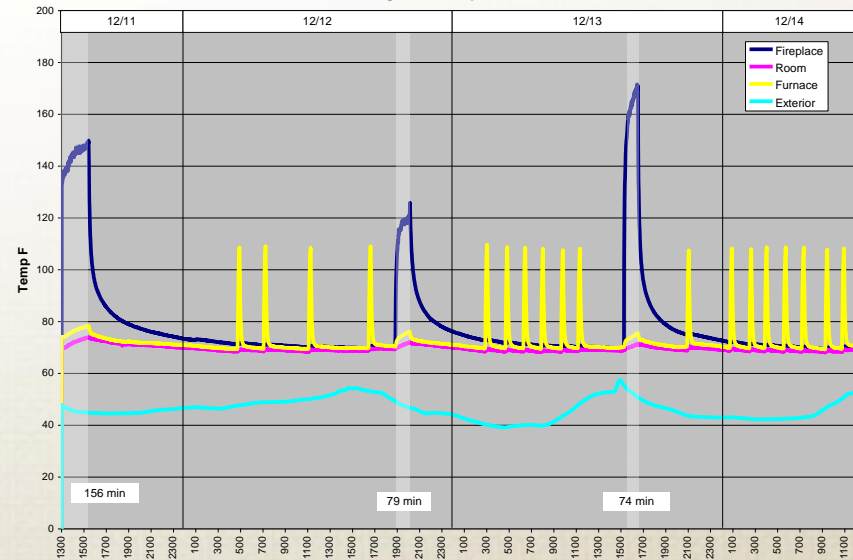


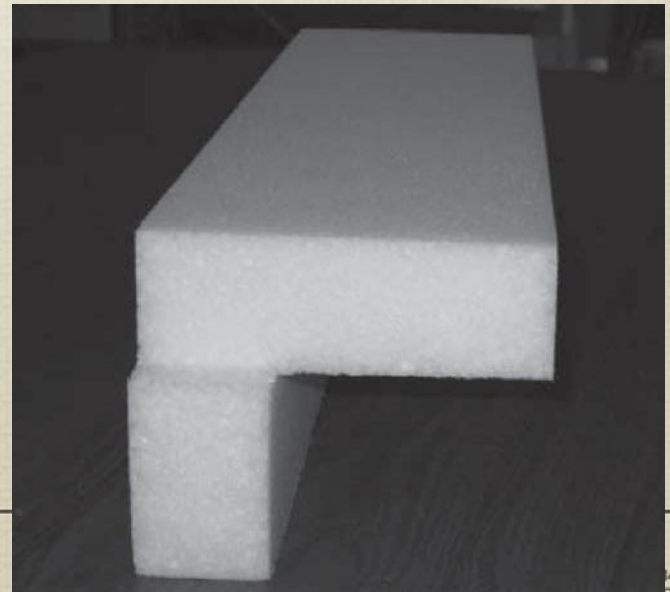
Figure 1: Fireplace Use



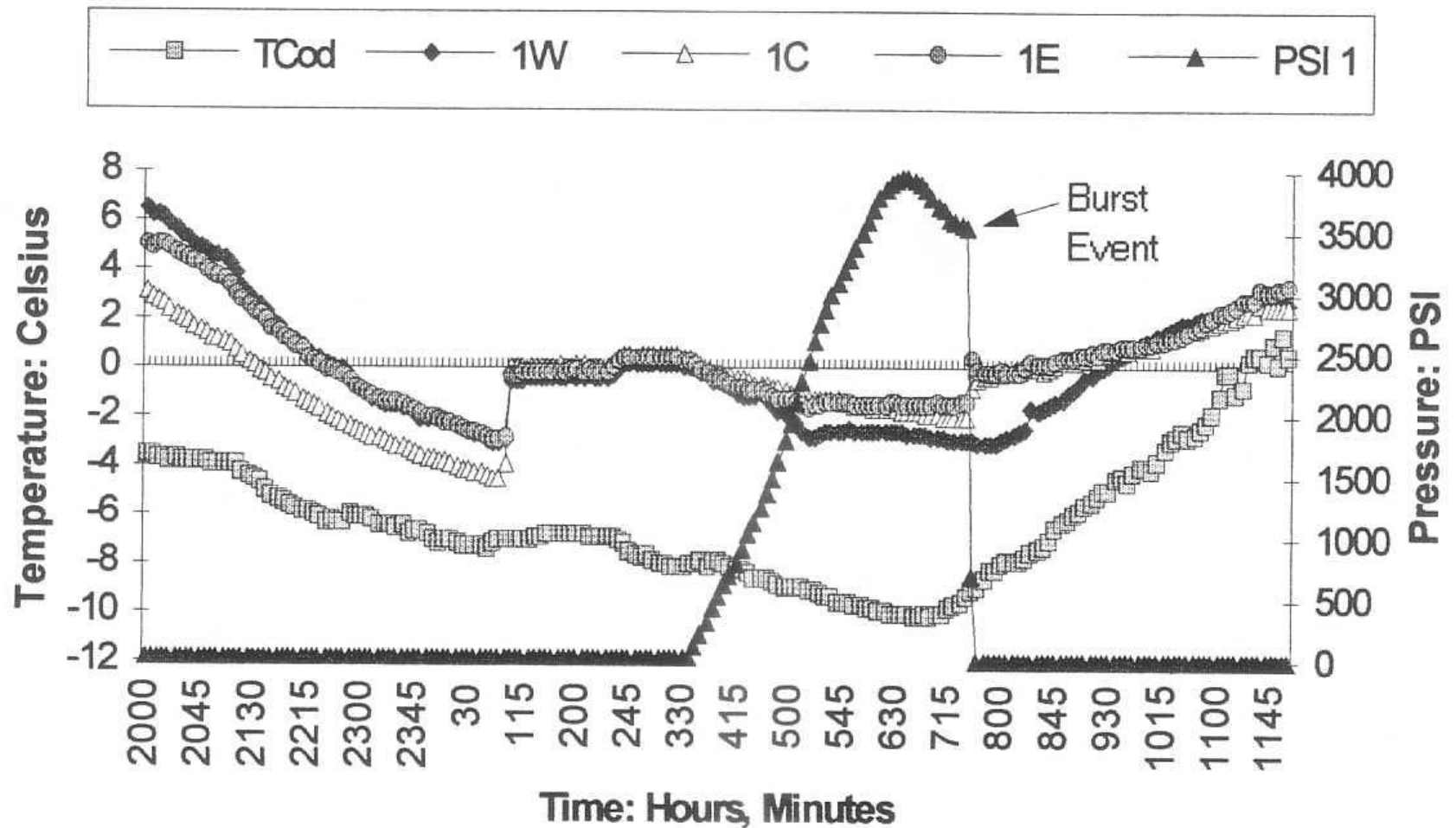
Research: Wall-Ceiling Junction



**Unfortunately, none of the methods
solved the problem**



Research: Pipe Bursting





Origins of building regulations

The 1/300 attic ventilation rule was proposed as a consequence of one data point in one study. “Condensation of moisture and its relation to building construction and operation” 1938. Frank Rowley, University of Minnesota.



FIGURE 20. CONSTRUCTION DETAILS OF ATTIC FOR ATTIC VENTILATION TESTS

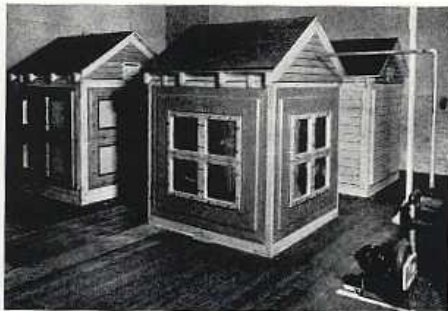


FIGURE 21. VIEW OF SETUP FOR VENTILATED AND UNVENTILATED ATTICS

TABLE XII
ATTIC VENTILATION

Outside Air Temperature, Degrees Fahrenheit	Inside Air Conditions		No Ventilation		Natural Ventilation		
	Degrees Fahrenheit	Per cent relative humidity	Attic air temperature, degrees Fahrenheit	Condensation ^a	Opening, square inch ^b	Attic air temperature, degrees Fahrenheit	Condensation ^a
+15	70	40	26.9	0.0	0.125	24.2	0.0
+10	70	40	22.6	0.0	0.125	19.9	0.0
+5	70	40	17.3	1.16	0.125	13.9	0.0
-10	70	40	3.9	2.38	0.125	0.2	0.53
+5	70	40	17.3	1.16	0.125	13.9	0.0
+5	70	30	17.6	0.78	0.125	14.6	0.0
+5	70	20	16.9	0.0	0.125	14.1	0.0
-10	70	40	3.9	3.15	0.125	0.2	0.53
-10	70	20	2.8	2.28	0.125	— 1.4	0.0
-10	70	40	3.9	3.15	0.125	0.2	0.53
-10	70	40	4.6	3.15	0.250	— 0.4	0.0
0	70	20	11.8	1.76	0.125	7.8	0.0
-15 to +15	70	20	.....	0.0	0.063	.....	0.0
+5	70	30	17.6	0.78	0.125	14.6	0.0
-15 to +15	70	30	.....	0.18	0.063	.....	Trace

^a Condensation in grams per square foot of ceiling area per 24 hours (1 gram=.0022 pound).

^b Opening in square inches in each gable per square foot of ceiling area.

^c Outside air supplied to attic space in cubic feet per hour per square foot of ceiling area.

Research: Attic Performance

- **Main conclusion: attic ventilation becomes inconsequential in attics with high R-value and tight ceilings.**



& Training

- **Mostly residential retrofit**
- **Focus on**
 - Building Diagnostics
 - Building Science
 - Cost-effectiveness
 - Health & Safety
- **Classroom and hands-on**



& Training

- **Curriculum Development**
 - Architectural contractors
 - HVAC contractors
 - Assessors
 - Alignment with program rules



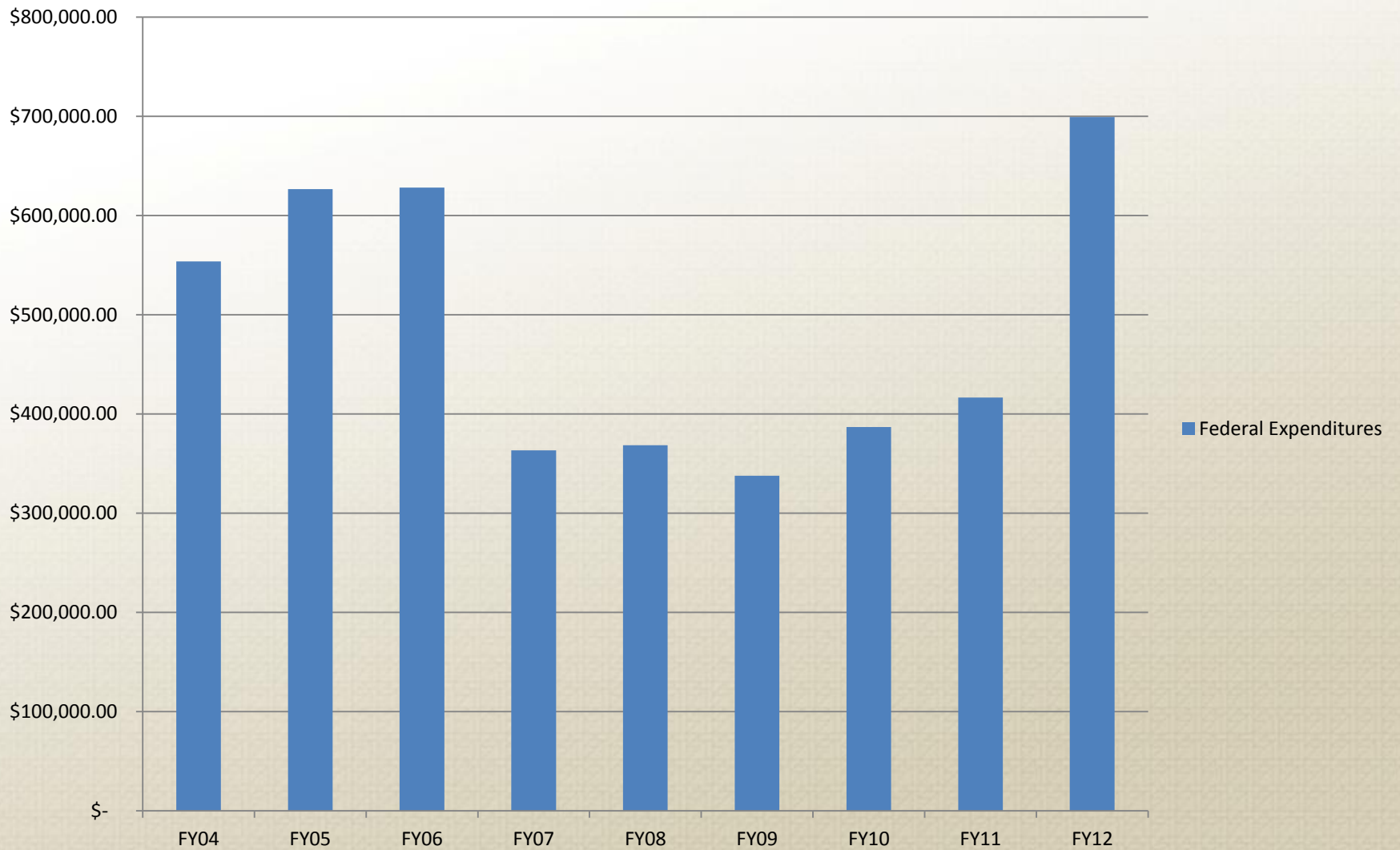
Training by the Numbers

- **Last year about 300 individuals who took 900 different classes**
- **A state of the art 6,700 square foot training facility**
- **Has a HVAC Mobile Training Laboratory and an Insulation Training Truck**
- **Over the five years about 600 individuals who took 2,500 different classes**

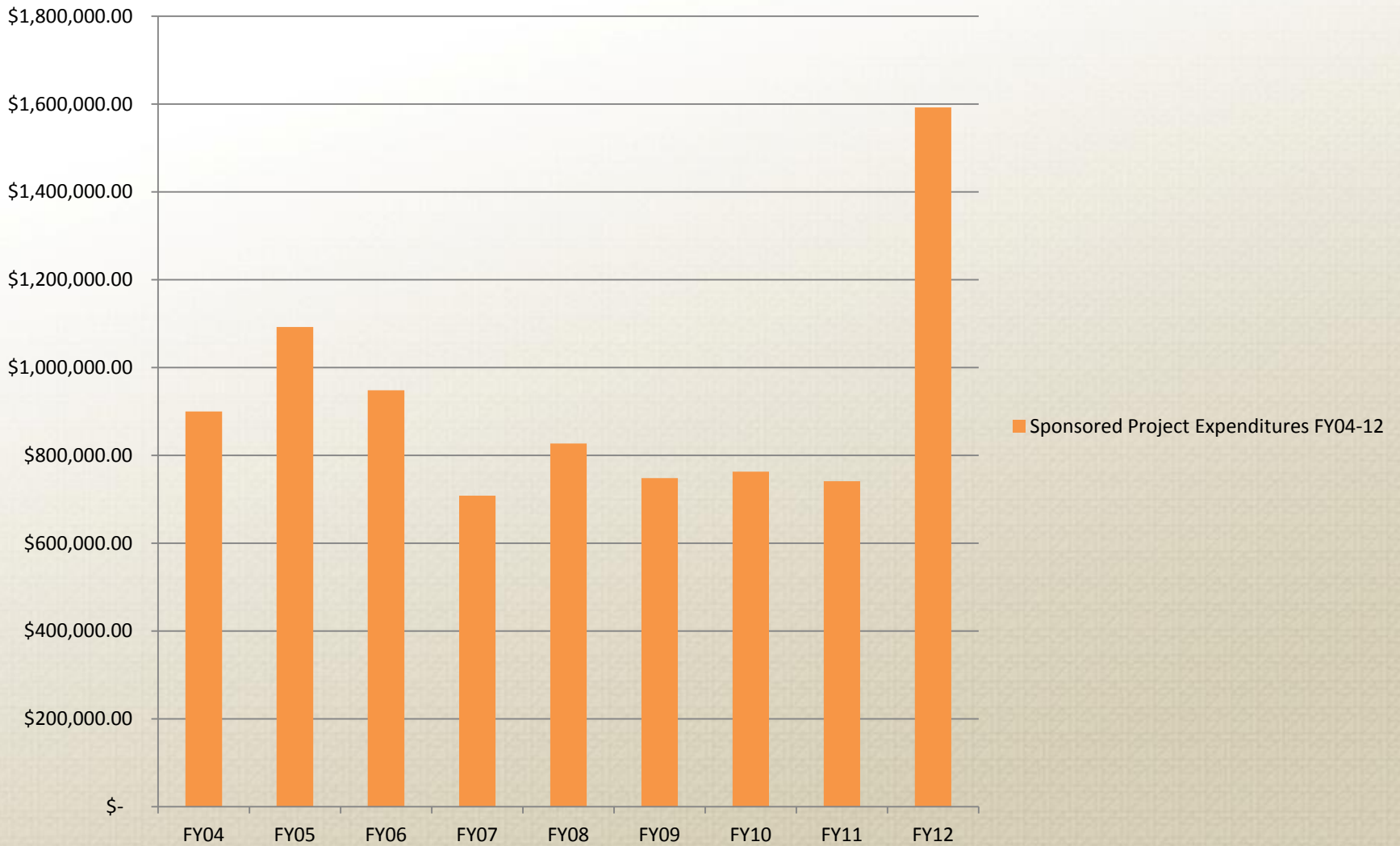
Training by the Numbers

- **Part of a larger DCEO effort, Illinois Home Weatherization Assistance Program (IHWAP)**
- **Over the last three years the program has weatherized over 42,000 homes, with nearly 20,000 homes weatherized in the past year.**
- **Weatherization typically reduces household energy consumption by 12 to 25 percent and improves indoor environmental health and safety according to DCEO.**

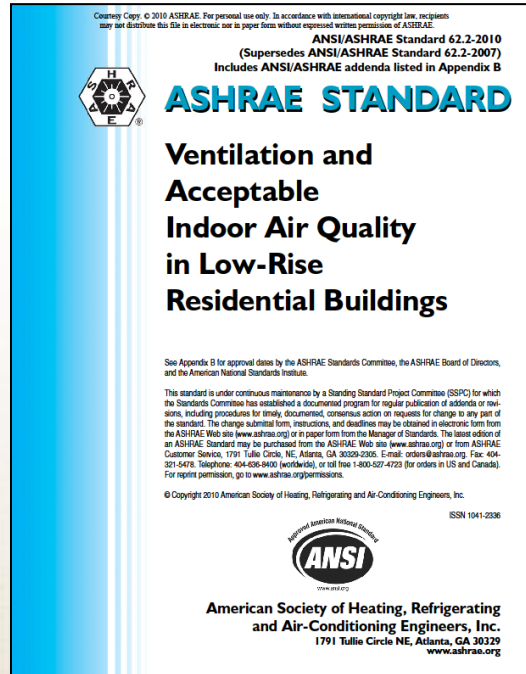
Federal Expenditures by Margaret Morrison



ISTC Sponsored Project Expenditures by Margaret Morrison



Public Service



- Building Performance Institute BoD
- Advisory committees for weatherization

Future Directions

- **Interstate Renewable Energy Council (IREC) accreditation of the Training Center**
- **Comprehensive building science curriculum**
- **More research, e.g.**
 - **Radon?**
 - **Combustion and IAQ, expanding to biomass?**
 - **Ventilation and health?**



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Thank You!
Any Questions?

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